
THE EFFECT OF DRIED RED GINGER POWDER (*Zingiber officinale* var *rubrum*) ON PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Red ginger (*Zingiber officinale* var *rubrum*) is a rhizome plant that is very popular as a spice and traditional medicine in Indonesian society. Ginger as a traditional medicine could be expected to lower the blood glucose of patients with diabetes mellitus type 2. Diabetes mellitus is a disease of high prevalence in the world, including Indonesia. This disease is a group of metabolic diseases with the characterization of hyperglycemia that occurs due to abnormal insulin secretion, insulin action or both disorders.

Objective: Determine the effect of the dried red ginger powder (*Zingiber officinale* var. *Rubrum*) on fasting blood glucose (FBG) and 2-hour postprandial blood glucose patients with type 2 diabetes mellitus .

Methods: This research is a clinical trial with 33 patients divided into two groups: the control group and the treatment group. Inclusion criteria were patients with type 2 at the age of 35-60 years. Exclusion criteria were patients with impaired liver, kidney, heart, stomach as well as pregnant and lactating mothers. The treatment group received a dry powder of red ginger with a dose of 3 grams per day with a standard medicines while the control group received a standard drug without dried red ginger powder . Both groups had examined the fasting blood glucose (FBG) and 2-hour postprandial blood glucose before and after treatment tested by analysis of covariance (ANCOVA) with a significance value of $p < 0.05$.

Outcome measured: Changes in the levels of FBG and 2-hour postprandial blood glucose.

Result: The result is dried red ginger can lower fasting blood glucose with significant value ($p=0.031$). While dried red ginger powder have no significant effect to 2-hour postprandial blood glucose.

Conclusion: Dried red ginger powder (*Zingiber officinale* var. *Rubrum*) at a dose of 3 grams per day, affecting the decline in fasting blood glucose. Dried red ginger powder (*Zingiber officinale* var. *Rubrum*) 3 grams a day, do not influence the 2-hour postprandial blood glucose .

Key word: Red ginger, diabetes mellitus type 2, traditional medicine

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases with hyperglycemic characteristic that occurs due to abnormal insulin secretion, insulin action or both disorders (Dipiro, 2008). DM is a disease of high prevalence in the world. In 2013, there were 382 million



people living with diabetes and the member will increase to 471 million people by 2035 (American Diabetes Association, 2004). Patients with diabetes mellitus has reached 8.5 million in 2013 and is expected to increase in 2035 which reached 14.1 million people in Indonesia. This figure makes Indonesia as the seventh highest number of people with diabetes in the world (American Diabetes Association, 2004).

Type 2 diabetes mellitus is a type of diabetes which is more common with the number of patients reached 85-95% of the overall population of patients with diabetes (American Diabetes Association, 2004). Etiology of Type 2 diabetes is multifactorial which has not been fully revealed clearly. Genetic and environmental factors influence is large enough to cause the occurrence of type 2 diabetes, including obesity, a diet high in fat and low in fiber, and lack of exercise (Katzung, 2007).

Diabetes mellitus therapy aims to achieve normal glucose levels, to reduce the onset and progression of retinopathy, nephropathy and neuropathy complications, intensive therapy for the associated cardiovascular risk factors, and to improve the quality and quantity of life (Dipiro, 2008). This therapy may include pharmacological and non-pharmacological therapies. Pharmacological therapy is treatment with drugs, while for non-pharmacological therapy is more focused on the patient's lifestyle such as diet and exercise (Dipiro, 2008).

In addition to the above two therapeutic treatment of diabetes mellitus that develops in the community using traditional medicine or the more common known as herbal medicine. Traditional or herbal medicine is an ingredient or ingredients in the form of plant material, animal material, mineral materials, preparation of galenic or mixtures of these materials, which for generations has been used for treatment based on experience (Departemen Kesehatan RI, 2004).

Traditional medicine recorded hundreds of years of its use for the treatment of one is ginger, which have traditionally been used to treat rheumatic diseases, asthma, stroke, tooth pain, infection, muscle pain, throat, cramps, hypertension, nausea, fever and diabetes (Ali, 2008) . The main content are the ginger essential oil (1-5%), sesquiterpenoids and monoterpenoids, gingerol, shogaols, paradols and zingerones (Shukla, 2007). Most of the therapeutic effects of ginger used as an anti-inflammatory, analgesic, hypotensive and diabetes associated with gingerol and shogaol are widely available in fresh ginger and dried ginger (Shukla, 2007).

Preclinical research studying the potential hypoglycemic ginger in mice that had been induced diabetes, by providing fresh ginger as much as 500 mg/kg per day for 7 weeks. The results showed that the effective doses in lowering serum levels of glucose, cholesterol and triacylglycerol (Al-Amin, 2006). In addition, other studies reported ginger therapeutic effect in osteoarthritis (Altman, 2001), musculoskeletal disorders (Srivastava, 1992), nausea and vomiting (Bryer, 2005), motion sickness (Lien, 2003), migraine (Mustafa, 1990).

Results of clinical studies showed that consumption of 3 grams of dried ginger powder every day in divided doses for 30 days can lower blood glucose, triglycerides, total cholesterol, LDL and VLDL in the blood (Andullu, 2003). However, the consumption of 2 grams of ginger every day for 8 weeks was not significant in lowering fasting blood glucose, HbA1c, HDL (Mahluji, 2013). So far, in Indonesia clinical studies on ginger has

been done, the study reported that the use of ginger in osteoarthritis patients may reduce the level of pain, but not to the stiffness of the joints (Bachtiar, 2010).

Although ginger has long been utilized in traditional medicine and research benefits of ginger to treatment also has a lot to do, but research into the use of dry powder of red ginger to decrease blood glucose of patients with diabetes mellitus has not been done so far in Indonesia. Under these conditions, researchers are interested to see the effect of the dry powder of red ginger (*Zingiber officinale* var. *Rubrum*) for type 2 diabetes mellitus patients in the clinic Hospital Dr. M. Yunus Bengkulu.

RESEARCH METHODS

Research Model

The subjects were the patients with diabetes mellitus type 2 who went for medical treatment in Dr. M. Yunus Bengkulu's hospital polyclinics. The sample was the adult male and female patients (30-60 years) willing to participate in the research. The exclusion criteria were patients with gastric irritation, hypothyroid, severe impaired liver, kidney, and heart functions identified from the physical examination, laboratory data, and supporting/additional investigation. The termination was also done to patients with worsen condition caused by the side effects, as well as to those who were in pregnancy and lactating. The patients were considered dropout as they withdrew from the study, were no longer control the disease to the hospital, or died.

Research Procedure

1. Before starting the research, an assessment to the research protocol has been conducted and announced having passed by local ethic committee.
2. Patients who were eligible and willing to participate in the study (as seen from the signed informed consent) were recorded for their personal identification FBS (Fasting Blood Sugar) and 2 Hours. Postprandial Blood Glucose These are the data prior to the study.
3. The patients were divided into two groups:
 - a. Group 1 (Control)
Not given dried red ginger extract powder.
 - b. Group 2 (Treatment)
Given dried red ginger extract powder, three grams per day.
4. The patients were given capsules for 30 day uses; each contains 500 mg of dried red ginger extract powder.
5. After 30 days, the patients' bloods were re- examined.
6. Finally, data analysis and hypothesis testing were conducted.

Statistical Analysis

To see the effect of the dosage form of dried red ginger extract powder to total cholesterol levels in both test groups, an Independent Samples Test with a significance value of $p < 0.05$ was conducted. This statistical test showed the change in the blood lipid profile value before the study (pre-treatment) and after the study (post-treatment).



RESULTS AND DISCUSSION

Result

Fasting Blood Glucose. 17 people that included a control group, the average fasting blood glucose before entering the study was 178.6 ± 38.68 mg / dL. Then one month later, the average fasting blood glucose of 160 ± 34.09 mg / dL. Furthermore, 16 of the treatment group, the average fasting blood glucose before entering the study was 177.5 ± 43.04 mg / dL. And one month later, the average fasting blood glucose showed near-normal value is 144.5 ± 33.19 mg / dL. Covariance analysis results obtained value $P 0.031 < 0.05$, which means significantly. This means that there is the effect of dried ginger powder preparation red on fasting blood glucose and is not influenced by age with a P value $0.555 > 0.05$, which means insignificant.

2 Hours Postprandial Blood Glucose. 17 people that included a control group, an average of 2 hours postprandial blood glucose before entering the study was 228.9 ± 65.83 mg / dL. Then one month later, an average of 2 hours postprandial blood glucose 195.7 ± 56.21 mg / dL. Furthermore, 16 of the treatment group, the average postprandial blood glucose 2 hours prior to entering the study was 257.6 ± 49.62 mg / dL. And one month later, an average of 2 hours postprandial blood glucose showed near-normal value is 231.6 ± 56.71 mg / dL. Covariance analysis results obtained value $P 0.514 > 0.05$, which means insignificant. This means that there is no effect of the dry powder preparation of the red ginger 2 hour postprandial blood glucose and is not influenced by age with a P value $0.374 > 0.05$, which means insignificant.

During the study the patients were explained the protocol standard with informed consent. Based on the description of patients willing to participate in the study until completion note that side effects that arise during the use of capsules containing a dried red ginger powder was dizziness (2 persons), diarrhea (1 person), a burning sensation in the stomach (4 people).

Discussion

Indonesian society has long been used as a traditional medicine treatment efforts alone. Along with the times, traditional medicine requires scientific proof of efficacy and safety so that it can continue to be used to improve public health. One example is the red ginger (*Zingiber officinale* var. *Rubrum*) are believed to have a wide range of medical benefits.

Red Ginger is one of the traditional medicine that is widely used for the treatment of such diseases as rheumatism, asthma, stroke, tooth pain, infection, muscle pain, throat, cramps, hypertension, nausea, fever and diabetes (Ali, 2008). Research on the clinical effects of ginger on humans showed that ginger has anti-nausea and antiemetic effect during pregnancy (Borrelli, 2005); pain in osteoarthritis (Altman, 2001).

Handling of red ginger rhizome in research begins with the sorting phase, red ginger rhizome soon be sorting that quality was maintained. Soil / dirt on the rhizome directly cleaned so rotten ingredients with healthy should be separated. Sorting goal is to reduce the amount of impurities carried in the material, preventing blisters the skin surface and facilitate washing.

Washing of the rhizome was taken to prevent contamination and spoilage that can affect the quality of the rhizome. Source of water to wash the rhizomes originate from the water company. How to wash by spraying pressurized and assisted with a brush made of plastic. Rhizomes are already washed soaked in water with a temperature of $40^{\circ}C$ for 14

minutes after it is drained directly using a container made of plastic, red ginger sliced subsequently cut crosswise with thickness 3mm. Incision affect the essential oil content in the dry ginger, slicing crosswise manner produces red ginger averaging the highest essential oil content (Almasyhuri, 2012).

Drying method aims to reduce the amount of water in the material in order to inhibit the growth of microorganisms that can cause damage and extend the shelf (Departemen Kesehatan Republik Indonesia, 1995). The ginger crude was standardisation for the water content was 10% (Standar Nasional Indonesia, 2005). The results of the water content of red ginger powder on the study released by the Center for Industrial Research and Standards Padang was 6.99%.

The content of essential oil to solar drying process can produce materials with volatile oil content is still relatively high in addition, it also requires a shorter time compared with drying aerated (Yuliani, 2009). Minimum requirements of essential oil content was 1.5% (Li, 2012). The results of the essential oil content of red ginger powder issued by the Center for Research and Industry Standardization Padang is 9.75%. Essential oils consist of a mixture of volatile substances with a composition different boiling points. In an article for the handling and processing of ginger explain the levels of essential oils and distillation techniques is influenced by the moisture content of the material that is distilled. Ginger essential oil can be obtained by refining crude drug ginger already diserbuk with water vapor evaporation method.

Parameter that must be met for the quality standard bulbs ginger is a moisture content of less than 12%, oil content of at least 1.5%, not moldy and has a distinctive aroma with a shelf life can be up to 12 months (Yuliani, 2009). It can be concluded that the use of red ginger powder researchers memenuhui quality standard bulbs.

Subjects in this study meets the inclusion criteria of patients with type 2 diabetes mellitus who went to the clinic diseases in Hospital Dr M. Yunus Bengkulu, with an age range of 30-60 years. This can affect the biological availability of investigational drug and drug dose adjustment was required. Another purpose of determining the age of a certain range was to obtain a homogeneous patient and prevent confounding factors that could bias the results of the research mebuat.

The exclusion criteria of this study were that patients should not be impaired liver function, kidney and heart, stomach irritation, pregnancy and lactation. This criterion aims to homogenize the state of the patient so that the bias of the study can be reduced. Another aim is to avoid the occurrence of side effects in patients who have been reported in previous studies such as the incidence of stomach irritation.

Red ginger doses given to patients was 3 x 2 capsules per day where one capsule contains 500 mg of dried ginger powder red. Clinical study using a dose of 3 grams of dried ginger powder every day for 30 days can lower blood glucose, triglycerides, total cholesterol, LDL and VLDL in the blood (Andallu, 2003). However, the consumption of 2 grams of ginger every day for 8 weeks was not significant in lowering fasting blood glucose, HbA1c, HDL (Mahluji, 2013).

The results of 33 patients with type 2 diabetes mellitus who follow the research showed that changes in fasting blood glucose values greater treatment group compared with the control group ($P < 0.05$). Preclinical study reported a decline in blood glucose at pre and posttest pangujian diabetic rats (Li, 2012). 6-gingerol compounds contained in ginger can decrease fasting blood glucose were tested on laboratory animals (Sign, 2009).



Other studies have also reported an increase in insulin sensitivity by 6 gingerol by increasing differentiation of 3T3-L1 adipocytes from preadiposit for glucose uptake in the cell membrane (Sekiya, 2004).

Red Ginger did not significantly influence the value of a 2 hour postprandial blood glucose in the treatment group and the control group ($P < 0.05$). Some studies have suggested that insulin resistance can cause different effects on fasting blood glucose and postprandial glucose 2 hours, fasting blood glucose can be normal if the problem is resolved resistance (O'Rahilly, 1994).

Inhibition of α -glucosidase enzyme can effectively reduce the digestion of complex carbohydrates and absorbsinya, so that it can reduce postprandial glucose levels in people with type 2 diabetes mellitus (Borgenberg, 2008). Jamaican ginger extract showed little inhibitory effect on α -glucosidase but not able to inhibit α -amylase. This result may be related to the low content of total phenolic compounds in water extract of ginger (Ranilla, 2000).

In this study 2 hour postprandial blood glucose declining trend in the control group was higher than the treatment group, this was expected because there are no restrictions on the amount of food intake in both groups. High dietary intake of glucose in the control group is estimated to be higher than in the treatment group so that the average reduction 2 hour postprandial blood glucose control group was higher than the treatment group.

The use of dried red ginger powder 3 x 2 capsules daily after every meal for a month showed that no adverse events reported by patients irritation. Irritation of the stomach is the major side effects that have been reported by previous researchers. Other side effects that arise during the study were diarrhea though only 2 of 16 patients who received treatment. Ginger can increase intestinal peristalsis thus estimated diarrhea in patients caused by it. In addition, some patients also feel a headache, burning sensation in the throat. This reaction causes one patient withdrew from the study on the second day of use. Yet another patient recognizes that this reaction only occurs in the first three days of drug consumption capsule that researchers provide. Then the reaction goes away by itself after 3-7 days of use.

CONCLUSION

Dried powder of red ginger (*Zingiber officinale* var. *rubrum*) at a dose of 3 grams can decrease fasting blood glucose significantly, but it can not decrease in postprandial blood glucose 2 hours significantly.

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DISCLOSURE: -

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